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ALSO A

METHOD OR FORM OF

Keeping the Field-Book,

AND

How to caſt up the ſuperficial Content of a PLOT moſt Exactly.

K Osborne (H.)

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Printed by WILLIAM BLADEN, *Anno Dom.* 1654.

To the Surveyers of Lands.

Gentlemen,

I *Think my ſelf obliged to render an account to you, what hath occaſioned the Publiſhing of this ſhort tract at this time, That I may not be thought either to affect an idle glory to my ſelf by putting a thing in Print, or to be deſirous if impoſing any thing herein upon other Men.*

Truly I muſt confeſs, that after ſeveral Experiments made for my own private ſatisfaction in the buſineſs of Survey, I finding the ordinary way of keeping a Book, and of Protraction, ſeldom to anſwer that exactneſs I expected, it made me to conſider how thoſe defects might (at leaſt in ſome meaſure) be ſupplyed; which brought into mind ſomething I had read of that kind, (in Mr. Norwoods *Sea-mans Practice) which after a more ſerious review and proof of, perceiving it to anſwer to my end, I formed ſome ſhort Rules out of it for my own particular uſe.*

Which caſually communicating to the Surveyer General, *upon a deſire expreſt by him: That the field Books might in the future Surveys, be ſo kept and ſo returned that it might be poſſible out of them to find how near each parcel of Land (ſurrounded by the Inſtrument) did cloſe upon drawing up of the Plot of it; Or in caſe any loſs or diſaſter ſhould come to any of the Plots, that new ones might be framed, by having the fair and true Copies of the ſaid field Books, reſpectively belonging to them.*

He, upon further Examination of it, and advice had with ſome other perſons concerning it, ſeeming alſo much to approve of this before the ordinary way of Protraction, and commanding me to take the pains to ſet the whole method of it down; to the end, That it might the better be examined, and that if no inconvenience could be demonſtrated in it, It might be the more generally imbraced. I, in order to the ſaid commands, and that I might not decline any ſervice injoyned me by the publick, have endeavoured to lay down the practical part, with all the plainneſſe I poſſibly could.

Wherefore premiſing only this caution to ſuch as ſhall go out into the Field, that

great care be had their Needle do play freely, and that it ſeat it ſelf always in the ſame poſition, in regard that upon the goodneſs of the Needle depends (upon the matter) the whole of Survey. *The commodities humbly conceived to be in the way here propounded above the uſual, are principally theſe following:*

Firſt, that (after the ſumming up of the Columns of the North, South, East, *and* West) *any one may know at the firſt ſight how much the Plot wants of cloſing even to a Link; and this before protraction is made, which cannot be done the uſual way, until the whole be firſt actually laid down; beſides that, in the uſual way after a man hath never ſo carefully plotted and laid down his work, if it cloſe not, it leaves him ſtill doubtful whether the Error be in the Field, or in the Plot, or in both.*

Secondly, It is a moſt abſolute way for laying down any Plot, for by the uſual way of Protracting, an error once committed is carried on through the whole plot: (if not augmented) whereas in this, if an Error ſhould be committed in one line, in the next line ſhall fall in his true place, and conſequently that Error goes no farther.

Thirdly, that for the caſting up the Area of any Figure, it will do it moſt exquiſitely, (and that without plotting if you will) Nay, a Plot caſt up the uſual way although a thouſand times as large, yet ſhall not the Content be caſt up ſo exactly as it may this way.

Laſtly, To find that there is an Error in the Field work, and yet not to know how readily to find it, will ſomething perplex: yet you have in this way ſome advantage more then in the uſual: for you ſhall ſee whether the Error be on the North *and* South *ſides of the Plot, or on the* East *and* West, *or both; and by this means ſhall be able to know where you ſhould run a line croſs your Work for the diſcovery of that Error.*

Whatſoever is here done with the Sine, and Sine Complement of Arches, in the plotting of Land &c. the ſame may be performed with the ſame Certainty by Tangents, and Secants of Arches; but that being beſides this buſineſs I ſhall ſay no more thereof, but remain ready to ſerve the Lovers of Mathematical Learning.

DUBLIN *April* 20. 1654. *Henry Oſborne.*

A

More Exact VVay to Delineate the Plot of any ſpacious parcel of Land, as Baronies, Pariſhes and Town-Lands: as alſo of Rivers, Harbours and Loughs, &c. than is as yet in Practice

Sect. I. *How to keep the Field Book.*

Aving taken and ſet down your notes (of Proprietors names and Lands, bounders, windings, &c.) in the Field on the left hand Pages of your Book, you may devide the right hand Page into ſix Columns, (as may be ſeen hereafter) in the firſt may be put the quantities of your lines meaſured in Chains and hundred parts, in the ſecond Column how many degrees and parts; the Lines you have traverſed, are diſtant from the *North* or *South* part of the Meridian towards the *Eaſt* or *Weſt*; the other four Columns are diſtinguiſhed by the names of *South*, *North*, *Eaſt* and *Weſt*: in the which are ſet down the *Eaſting*, *VVeſting*, *Northing* and *Southing* of the Degrees and Diſtances obſerved by a Table (the making and uſe whereof ſhall be ſhown) and for the eaſie underſtanding of which, we ſhall here affix a Table ſo divided and noted as aforeſaid, anſwering to the Scheme adjoyning in which ſuppoſe the line from A. unto B. to be 73. Degrees to the *South* towards the *VVeſt*, and the length of the line A. B. to be 14. Chains and 70. links; again the line B. C. to be 75. Degrees and 36. from the *South* towards the *VVeſt*, and the length of the line B. C. to be 20. Chains :40. links, and alſo the line C. D. to be 87. Degrees from the *South* toward the *VVeſt*, and length C. D. 10. Chains :50. links; the line D. E. 9 Chains :70 links, and the Angle 73. Degrees 30. minutes from the *South* to the *Weſt*,

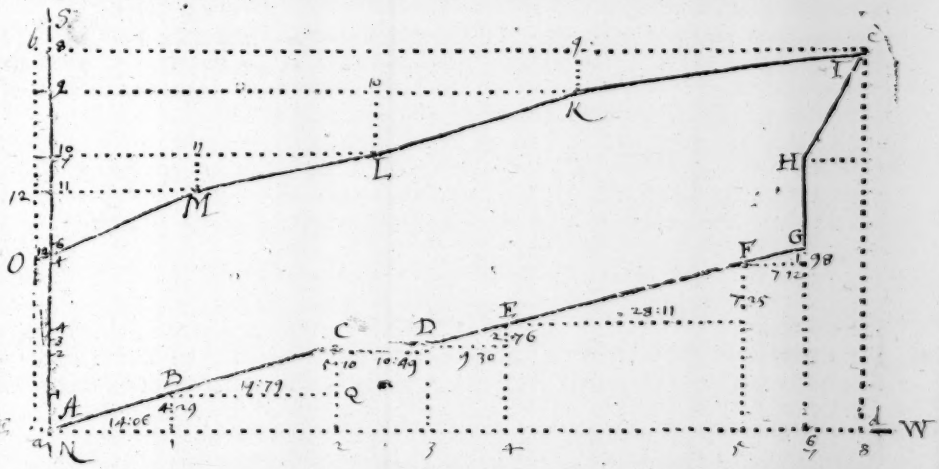
and this Order is to be observed in all the rest till you have finished your surround, and may more plainly appear by the subsequent Table.

Distances.	Angles.	South.	North.	East.	West.	X	Z
14 :70	73 :00 S W	4 29			14 :06	4 :29	14 :06
20 :40	75 :30 S W	5 10			19 :79	9 :39	33 :85
10 :50	87 :00 S W	0 55			10 :49	9 :94	44 :34
9 :70	73 :30 S W	2 76			9 :30	12 :70	53 :64
29 :00	75 :30 S W	7 25			28 :11	19 :95	81 :75
7 :40	74 :30 S W	1 98			7 :12	21 :93	88 :87
10 :60	*South.*	10 60			00 00	32 :53	88 .87
14 :60	28 :30 S W	12 84			6 97	45 :37	95 :84
33 :95	82 :00 N E		4 :74	33 :61		40 :63	62 :23
25 :00	72 :00 N E		7 :74	25 :75		32 :89	38 :48
21 :40	78 :30 N E		4 :28	20 :97		28 :61	17 :51
21 :00	65 :30 N E		8 :71	19 :11		19 :90	1 :60
20 :00	4 :30 N W		19 90		1 60	00 :00	00 :00
238. 25		45. 37	45. 37	97. 44	97 :44	X	Z

Sect. II. *Of the Construction and use of a Table for the more ready and exact laying down of any right Lined* Figure.

THe making of this Table is very easie, out of the Tables of natural Sines for each Degree and half Degree of the Quadrant; (or nearer if one please) for if you multiply any distance run, by the Sine and Sine Complement answering that Degree of Azimuth you measured on, the Products shall be the number to be put in the *North* or *South* Column, and *East* or *West*; for the reason is evident from the first Axiom of plain Triangles, that if the Hypotenusa (in a right angled Triangle) be put as Radius the base, and Cathetus shall be Sines of their opposite Angles: Now in this case, the lines measured are put as the Hypotenusa, and supposed Radius and therefore the sides shall be in proportion to the Sines of their opposite Angles, and the Ratio will be as Radius, is to the Distance of two places measured in their Rumbe: so is the Sine Complement of that Rumbe to a fourth number, to be put in the Meridian either Northward or Southward, according as the Rumbe lyeth *North* or *South*. Again as Radius is to the distance of two places measured in their Rumbe: so is the Sine of the Rumbe to a fourth number, to be put in the line of *East* or *West*, according as the Rumbe lieth *Eastward* or *Westward*; and this may suffice for the construction. Now to the use, supposing our Tables already

already made, now this Table is made for every Degree and half Degree of the Quadrant from the *North* or *South* towards the *East* or *West*, and is only the Sine Complement of every of these Degrees and parts, made into a Table by Duplication, Triplication, Reduplication and Bipartition, *&c.* unto ten; by the help whereof, you may make the Numbers only by addition; which Numbers multiplyed unto ten I use whither my Number of Chains be under Ten, a Hundred, or a Thousand: only observe, that the Numbers in the Table stand for any Number of Chains under Ten; but if they shall amount unto Twenty Chains or above, and less than two Hundred, you are to adjoyn a Cipher to the Number found: but if your Number of Chains shall exceed two Hundred Chains, and less than two Thousand, you are to adjoyn two Ciphers to the Number found, *&c.* But if you shall have any odd Links, you are to seek them as if they were whole Chains, only with this caution, that if your Links exceed Ten, you cut off one Figures towards the right hand: but if under Ten, then you cut off two Figures towards the right hand; the residue you place under the Number of Chains, and then add them up into one Sum, and cut of the two last Figures toward the right hand, the remainder shall shew the Number of Chains and those two Numbers cut off, shall be the Nnmber of Links. An example or two will make all easie, and shew how the Numbers in the Columns of *North*, *South*, *East* and *West* in the little Table are made, which observe well.



Let the Line A. B. contain in length 14 Chains, 70 Links, and the Angle observed is 73 Degrees from the *South* part of the Meridian towards the *West*, under 73 Degrees in the Table, and against 10 in the side I find 292; also under 17 degrees (the Complement of 73 Degrees to 90.) and against 10 in the side I find 956 these two Numbers I place thus, then in the same Table under 73 Degrees, I seek my four Chains against 4 in the side, and I find 117 to be added to 292 afore found; also in the next Column under 17 Degrees, and against 4 in the side, I find 383 to be added to 956 found in the said Table as before. Now here are 70 Links, which 70

292	956
117	383
20	67
4:29	14:06

I seek

I ſeek under 73 Degrees, and againſt 7 in the ſide, and find 205; alſo againſt 7 in the ſide, and under 17 Degrees I find 669; now according to the rule, becauſe above ten Links I cut off the laſt Figure to the right hand, and they ſtand thus 20: 67 to be added to the aforeſaid Numbers, this done I ſum up theſe Numbers, and they will be 429 and 14 06 but when I have cut off the two laſt Figures to the right hand, then they will be 4: 29 and 14: 06, that is 4 Chains 29 Links to be put in the *South* Column, and 14 Chains 6 Links to be put in the *VVeſt*; and alwaies obſerve to put the Number ariſing from the Degree you meaſured on, into the Column of *South* or *North*, according to his Title: and the Number ariſing from the Complement in the Column of *Eaſt* or *VVeſt*, with regard to his Title. The ſecond line B. C. is 20 Chains 40 Links, and the Angle 75: 36 firſt I ſeek under 75: 36 and againſt 2 in the ſide (becauſe my Table gives not 20) I find 50 alſo under 14: 36 the Complement of 75: 36 in the Column adjoyning I find 194 to both theſe, I adjoyn a Cipher according to the rule, and they will ſtand thus alſo in the ſame Column, and againſt 4 I ſeek 40 Links and I find 100 and 387 which when I have cut off the laſt Figure to the right hand, they will ſtand thus 11 and 29 which added to the former Numbers and the two laſt Figures cut off it will be 5 Chains 10 Links for the *South*, and 19 Chains 79 Links to be put into the *Weſt*, and ſo I proceed with all the reſt until I have finiſhed; and being thus return'd unto my firſt ſtation, I ſum up ſeverally theſe four Columns of *South*, *North*, *Eaſt* & *Weſt*, and finding that the ſum of the *South* Column is equal to that of the *North*, and the ſum of the *Eaſt* is equal to the ſum of the *Weſt*, I conclude the work to be truly performed; whereas if there had been any difference it ſhews an Error, and if that difference had been great, it is neceſſary to examine the work again, and ſo to correct it; and thus much for our buſineſs in the Field, we come now to the plotting. And for our more quick diſpatch, we add ſeverally the ſeveral Numbers in each Column together, as in the Example following; and here I begin with the *South* Column, and put them into the Table noted with X thus, 4: 29 4: 29 & more by 5: 10 is equal to 9: 39. and 9: 39 added to 0: 55 is equal to 9: 94. and 9: 94 added to 2: 76 is equal to 12: 70. and 12: 70 added to 7: 25 is equal to 19: 95. and 19: 95 added to 1: 98 is equal to 21: 93. & 21: 93 added to 10: 60 is equal to 32: 53. & 32: 53 added to 12: 84 is equal to 45: 37. And thus is the *South* Column ſummed up, and the ſeveral Numbers in the *Northern* Column, are to be ſubducted out of the *South* Column; Thus 4: 74 ſubſtracted from 45: 37 there reſts 40: 63. and 7: 74 ſubducted from 40: 63 there reſts 32: 89. and 4: 28 ſubſtracted from 32: 89 there remains 28: 61. and 8: 71 ſubducted from 28: 61 there reſts 19: 90. and 19: 90 ſubducted from 19: 90 there reſts 00: 00. And thus you ſee I have drawn the *North* and *South* Columns into the Column X. I ſhall proceed in the ſame manner with the *Eaſt* and VVeſt Columns, as to draw them into the Column Z. firſt 14: 06 and 14: 06 added to 19: 79 is equal to 33: 85. and 33: 85 added to 10: 49 is equal to 44: 34 & 44: 34 added to 9: 30 is equal to 53: 64. and 53: 64 added to 28: 11 is equal to 81: 75. & 81: 75 added to 7: 12 is equal to 88: 87. and 88: 87 added to 00: 00 is equal to 88: 87. (and this is the reaſon of twice 88: 87 in the Table Z) & 88: 87. added to 6: 97 is equal to 95: 84. and ſo far is the *Weſt* Column ſummed up: the *Eaſt* Column follows, and is to be ſubducted out of the *Weſt* thus, 33: 61 ſubſtracted from 95: 84 there reſts 62: 23. and 23: 75 ſubducted from

500	1940
10	39
5:10	19:79

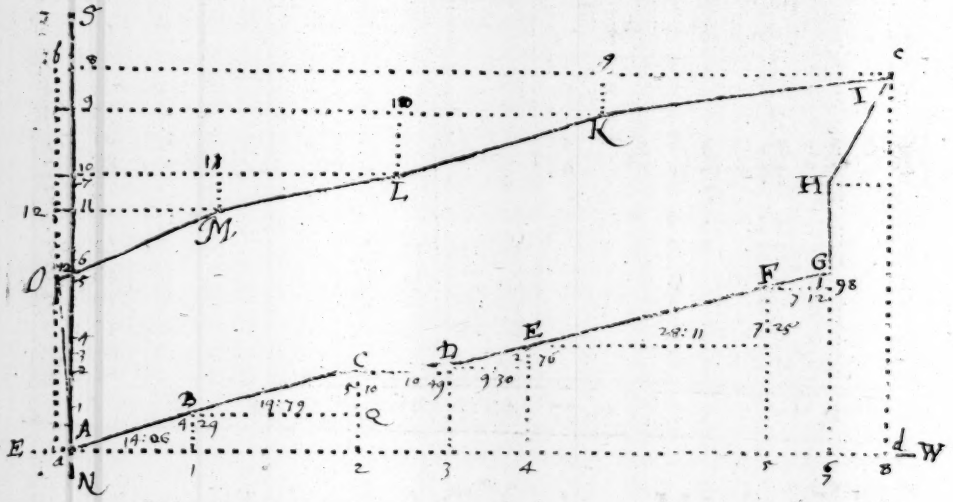
from 62:23 there rests 38:48. and 20:97 subducted from 38 48 there rests 17:51. and 19:11 substracted from 17:51, which becauſe I cannot do, I ſubduct 17:51 out of 19:11 there reſts 1:60. *Eaſt*, from which I ſubduct 1:60 in the *Weſt*, and there remains 00:00. And thus is my two Columns of X and Z made, by which I lay down the Scheme.

Diſtances.	Angles.	South.	North.	Eaſt.	Weſt.	X	Z
14 :70	73 :00 S W	4 29			14 :06	4 :29	14 :06
20 :40	75 :30 S W	5 10			19 :79	9 :39	33 :85
10 :50	87 :00 S W	0 55			10 :49	9 :94	44 :34
9 :70	73 :30 S W	2 76			9 :30	12 :70	53 :64
29 :00	75 :30 S W	7 25			28 :11	19 :95	81 :75
7 :40	74 :30 S W	1 98			7 :12	21 :93	88 :87
10 :50	*South.*	10 60			00 00	32 :53	88 .87
14 :60	28 :30 S W	12 84			6 97	45 :37	95 :84
33 :95	82 :00 N E		4 :74	33 :61		40 :63	62 :23
25 :00	72 :00 N E		7 :74	25 :75		32 :89	38 :48
21 :40	78 :30 N E		4 :28	20 :97		28 :61	17 :51
21 :50	65 :30 N E		8 :71	19 :11		19 :90	1 :60
20 :00	4 :30 N W		19 90		1 60	00 :00	00 :00
238. 25		45. 37	45. 37	97. 44	97 :44	X	Z

Sect. III. *How to Delineate the Scheme.*

CONſidering which way the Ground lies, I take a point for my firſt Station; So as the whole may fall conveniently within the Plot, which let be the point A. By which point I draw a Meridian and Paralel, namely two right lines interſecting one another at right Angles, whereof let N S be the Meridian running *North* and *South*, and E W. the Paralel running *Eaſt* and *Weſt*: And firſt I look to the *South* and *North* Columns, and there in the *South* Column, and againſt the firſt ſtation I find 4:29. and even with it in the *West* I find 14:06 then with my Compaſſes, on a Scale of equal parts, I meaſure this 4:29 on the Meridian line, from A, towards S, to 1. Alſo I take the length of 14:06 of the Scale, and ſet it on the line of *Eaſt* and *Weſt*, from A to 1; then keeping your Compaſſes at that diſtance, ſet one point in the Meridian line at 1, and with the other point deſcribe a ſmall Arch towards B. then ſet the Compaſſes to the firſt diſtance 4:29 and ſetting one point in 1 on the line of *Eaſt* and *Weſt* Croſs the aforeſaid Arch, and in the point of croſſing note it with a prick, and a line drawn from this point to the point A repreſents my firſt line A B 14:70. Then I obſerve againſt my ſecond Station in the Column X Z. for the *South* 9:39 and for the *Weſt* 33:85. Firſt I take the 9:39 on the Scale of equal Parts and lay it as before on the Meridian line N. S. from A. to 2; alſo I take the length 33:85 and meaſure it on the line of *Eaſt* and *Weſt* from A to 2. then

keeping your Compaſſes at that diſtance ſet one point in the Meridian line at 2. and with the other foot deſcribe an Arch toward C. then ſetting the Compaſſes at the former diſtance 939 ſet one point in the Line of *Eaſt* and *Weſt* at 2. and with the other foot Croſs the aforeſaid Arch, and note the point of croſſing for a line drawn from thence to the point B. is my ſecond line 20 :40, and thus you may lay down the diſtances C. D. E. &c. till you have included the figure, the practice of this but once makes all perfect.



Sect. IIII. *How to caſt up the Superficial Content.*

NOw for the exact caſting up the Area, the very bare Inſpection will Declare it; for in the firſt Triangle A. B. 1, it is plain by the Table that the Baſe is 14 : 06, the Cathetus 4 : 29; the ſecond Triangle B. C. Q. the Baſe 19 : 79 and the Cathetus 5 : 10; alſo the Parallelogram 1. B. 2. Q. hath for his ſides the Cathetus of the firſt Triangle 4 : 29, & Baſe of the ſecond Triangle 19 : 79; So it is obvious for all the reſt; then having conſidered the length & breadth of the Rectangle Figure *a b c d* (within which the greateſt extent of your Plot is contained) drawn into one another, and from the product you ſhall ſubduct the products of all thoſe Triangles, and Parrallelograms comprehended within the ſaid Rectangle Figure, and perimeter of your Plot; the remainder ſhall be the Superficial Content of that Figure: as in the foregoing Scheme the ſides of the Rectangle Figure containing the Plot are 45 :37 and 97: 44, which drawn into one another, is 44208528; and the Products of the ſeveral Triangles and Parrallelograms are 23799003; which ſubducted from the former, there reſts 204: 09525, which are the Number of ſquare Links in the Plot, and if your Chain be four Pole; than are you to cut off the five laſt Figures towards the right hand, the reſidue ſhall be the Numbers of Acres,

as

as thus, 204: c9525 is 204 Acres, and 9525 Links; but if your Chain be two Pole, then the fourth part of this number ſhall be the Number of Acres, *viz.* 51 Acres and 2381 Links, or almoſt 4 Perch; for like Plains are in a Duplicate Ratio to their Homologal ſides by 20. *Eucl.* 6. (that is) as a Quadrat to a Quadrat; and therefore if three Lines are proportional, it ſhall be as the firſt is to the third: So is the ſuperficies upon the firſt, to the ſuperficies on the ſecond; For example, 1. 2. 4. are proportional therefore as 1. is to 4: ſo is the ſquare of 1. to the ſquare of 2. upon this depends the reaſon of reduction of Plots or quantities, either bigger or leſſer.

FINIS.